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How much does it cost to look like a pig in a wild boar group?

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ABSTRACT

Hybridization between domestic and wild species is known to widely occur and it is reported to be one of the major causes of the current biodiversity crisis. Despite this, poor attention has been deserved to the behavioural ecology of hybrids, in particular in relation to their social behaviour. We carried out a camera trap study to assess whether phenotypically anomalous colouration in wild boar, i.e. potentially introgressed with domestic pigs, affected the hierarchical structure of wild boar social groups. Chromatically anomalous wild boars (CAWs) were detected in 32 out of 531 wild boar videos. In most videos (75%) CAWs were the latest of the group, independently from their age class and group composition. Aggressions by their wild type fellows were recorded in 31.25% videos; by contrast, no aggression among wild type individuals was observed. The lack of camouflage may expose CAWs, and thus their group, to a higher predation risk, compared to wild type groups. This individual loss of local adaptation may increase predation risk by the wolf or detection by hunters, being maladaptive for the whole social group.

1. Introduction

Phenotypic differentiation, including temperament (Réale et al., 2007), morphology (Outomuro and Johansson, 2015) and coat colour (Palleroni et al., 2005; Ancillotto and Mori, 2016), may have important consequences on the individual fitness and survival. Despite this, with the only exclusion of temperament, no information is available on how different phenotypes are perceived within a population or a social unit.

The wild boar (*Sus scrofa*) is the most widespread ungulate species in Europe (Oliver and Leus, 2008). Its distribution is a result of its wide feeding niche (Schley and Roper, 2003), life history (Gamelon et al., 2013) and ecological plasticity, which have favoured a great adaptability to many environmental conditions (Podgórski et al., 2013). In addition to the species characteristics, human (e.g., changes in farming practices and land abandonment: Geiser and Reyer, 2005; Hearn et al., 2014) and climatic changes (Koening and Knops, 2000; Melis et al., 2006) have resulted in a considerable increase of distribution range and density of the wild boar throughout the last decades (Apollonio et al., 2010). The wild boar may be responsible for extensive damages in crop fields and forests, thus for heavy economic losses throughout Europe (Keuling et al., 2008). By contrast, it is also considered an iconic game species of prime interest by European hunters and, as a consequence, it is intensively managed. Unfortunately, human activities (e.g. translocations and reintroductions) are rarely documented: therefore, the origin and genetic status of the involved animals is heterogeneous, sometimes involving the release of alien subspecies and captive-bred individuals (Apollonio et al., 2014). This last group is often the result of cross-breeding practices with domestic pigs (Goulding, 2001; Canu et al., 2014). The main threat by these uncontrolled releases is the genetic pollution of local stocks, which may lead to the occurrence of exotic/human-selected gene variants, with relevant fitness consequences.

Despite hybridization between wild and domestic pigs has been reported in several European countries (Koutsogiannouli et al., 2010; Goedbloed et al., 2013), with introgression of domestic phenotypes (Canu et al., 2016) in wild populations, no information about the possible effects on wild boar social structure is available. Wild boar social organization has been thoroughly studied: even if it may seasonally change, the most frequent groups are composed by adult females with piglets and few subadult females (Briedermann, 1986; Dardaillon, 1988). Female family groups are often based on kinship (Kaminski et al., 2005; Poteaux et al., 2009),

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whereas adult males outside the breeding season are often alone (Maselli et al., 2014). Aggregations of unrelated adult females and piglets have been recorded especially where hunting pressure occurs (Iacolina et al., 2009). The wild boar, as well as other Suidae, shows a complex and dynamical social organization ruled by social interactions, with subordinate (i.e. non-breeding) individuals often placed at the periphery of the group (Teillaud, 1986; Gonyou, 2001). Anomalous individuals (e.g. with coat colours preventing camouflage) may increase the predation risk in a wild-type social group: aim of this paper was therefore to assess whether chromatic anomalies influence the hierarchy within wild boar social units.

2. Material and methods

2.1. Study area and camera trapping

The camera trapping survey was carried out in the North-Eastern part of the province of Grosseto, Central Italy (43.081°N 10.996°E; 1350 ha; 475–903 m a.s.l.; Fig. 1). Over 67% of the study area is covered by deciduous woodlands (*Quercus cerris, Castanea sativa, Ostrya carpinifolia, Carpinus betulus, Fraxinus ornus* and *Robinia pseudoacacia*). Shrubwood (*Juniperus communis*, *Rubus ulmifolius* and *Spartium junceum*: 1.71%) forms a belt around the woodlands. Fallows count for 19.49%; cultivations cover the 7.78% of the study site and include sunflowers, cereals and vegetable gardens (Mori et al., 2014). Coniferous woodlands (*Pinus nigra* and *Cupressus arizonica,* 2.02%) and human settlements (1.97%) cover the remaining part of the study area. Three brooks and some ponds fed by rainfall are present. The local climate shows sub-montane features: during our survey, average annual rainfall has been 891 mm, with two episodes of snowfall; the average annual temperature was 15.3 °C. Drive-hunt to wild boar is practiced throughout the study area, between the 1st of November and the 31st of January. The wild boar is the most abundant mammal species in the study area (Mori et al., 2014).

Camera-trapping data were obtained during a 5-years mammal survey (January 2011-April 2016). We used 4 camera traps Ziboni Tecnofauna Explorer Case 1988 and 3 camera traps Multipir 12. This survey involved 1785 trap nights at 25 trap sites, which were evenly distributed throughout the study area and included all the detected habitat types (Fig. 1).

2.2. Data analysis

A total of 32 videos (out of 531 with wild boar) showing chromatically anomalous wild boar (hereafter, CAWs) were obtained during the survey. All the videos with CAWs were assigned to different groups of wild boar, as CAWs are individually identifiable through the coat pattern. Date, locality, habitat type and coordinates were assessed to characterize each camera site (Fig. 1). Each video was checked by an operator, and a list of variables was determined to describe the social composition of the groups. Aggressive behaviour (harassment, biting and/or fighting) between CAWs and the other members of group was recorded and used for descriptive analysis. Total number of individuals (total group), number of CAWs (CAW-group) and number of wild type individuals (wild boar-group) in the group were counted. Individual age was visually estimated using three categories: adults (>2 years), yearlings (1–2 years) and piglets (<1 year). In our analyses, given the small sample size, we used only three categories to represent the wild boar social group structure: adults, yearlings and mixed group (i.e., composed by individuals with different ages). G-tests for independence were performed to assess whether aggressions were equally performed and received by wild boar of different age classes, as well as to determine whether CAWs evenly occurred among age classes (McDonald, 2009).

Position of CAWs in the group was reported as a dichotomous variable: 1) animal was at the head (i.e. dominant) or in the middle of the group; 0) it was in the last position (i.e. subordinate). We used a binomial test to assert if the position of CAWs in the group was statistically different from a random expectation. The Mood's median test was used to assess whether the position of the CAWs differed in relation to the number of individuals belonging to the social unit. The Kruskal-Wallis test was performed to test medians among groups of different age classes. Explorative analysis (Shapiro-Wilk normality test: $W = 0.912$; $P = 0.0003$) was conducted before applying non parametric test (Zuur et al., 2010).

3. Results

A total of 283 wild boar were counted, with mean group size of 8.82 individuals (SD ± 2.23): 83.40% showed a normal phenotype, whereas the remaining 16.60% were CAWs. In 75% of videos, CAWs were in the back of the group. Physical aggressions by their fellows occurred in 31.25% of videos (see Supplementary Material

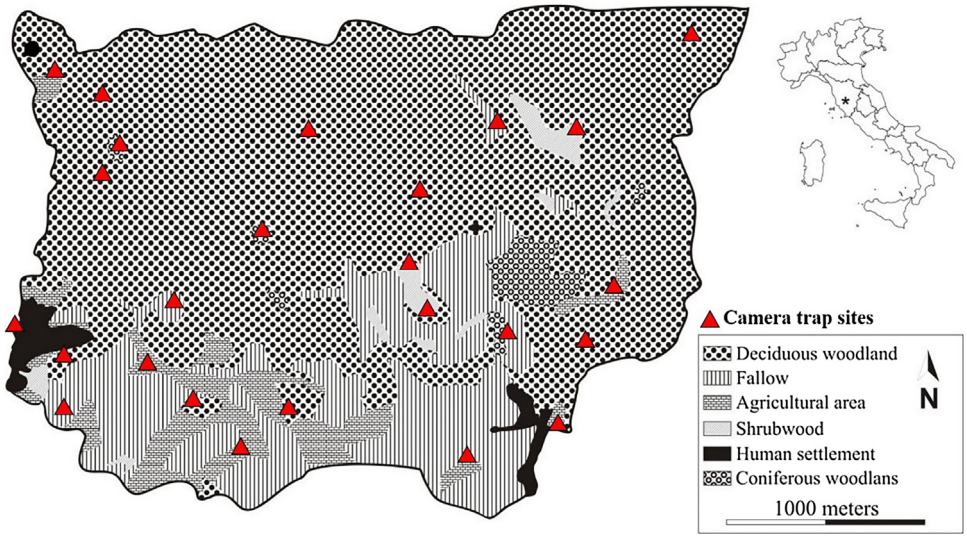

Fig. 1. Location and habitat composition of the study area. Camera trapping sites are also showed.